(12) UK Patent Application (19) GB (11) 2 123 306 A

(21) Application No 8318067
(22) Date of filing 4 Jul 1983
(30) Priority data
(31) 8202679
(32) 2 Jul 1982
(33) Netherlands (NL)
(43) Application published
1 Feb 1984
(51) INT CL³
A63H 33/26 33/04
(52) Domestic classification
A6S 35 6F 6H1 6HX
G5G 10X 5B
(56) Documents cited
GB 1225261
DE A 1239876
(58) Field of search
A6S
A6H
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(54) **Magnetic toy or instruction apparatus**

(57) A play and instruction apparatus comprises hollow, spherical non-magnetizable envelopes (1,2), and a permanent bar-like magnet (7) positioned within each envelope (1, 2) the magnet (7) having end faces curved analogously to the spherical envelope. The weight of the non-magnetic material in the spherical element (5) is minimised relatively to the magnetic strength of the bar-like magnet (7). Several such elements together with plates formed with dimples or apertures may form a toy construction set. Alternatively, the elements may be used for teaching numbers or letters.

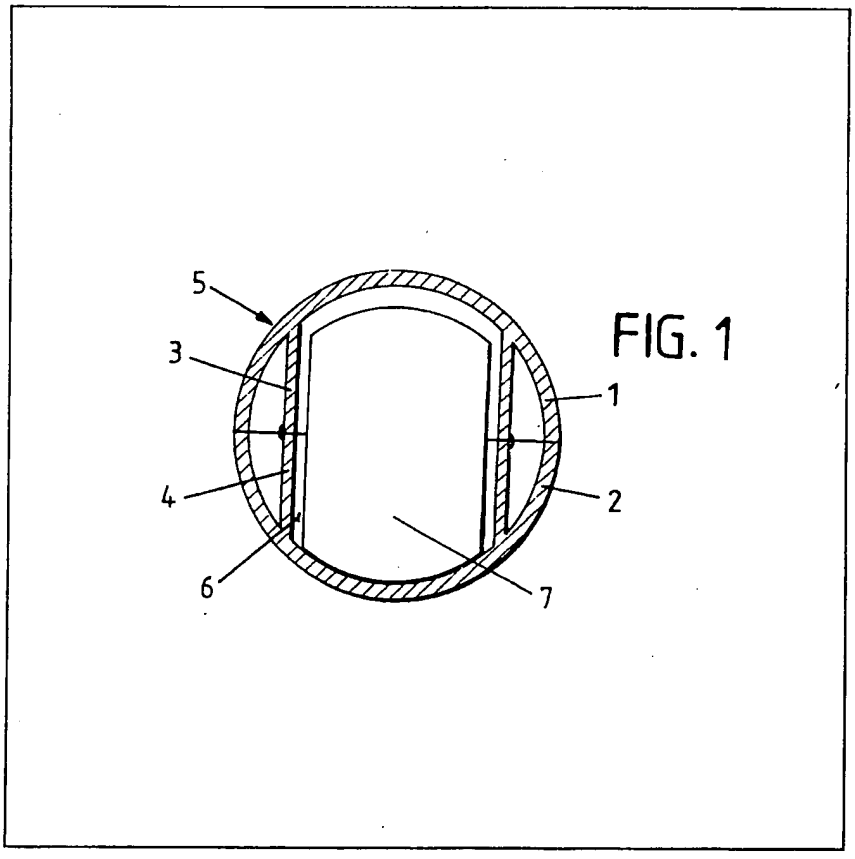


FIG. 1

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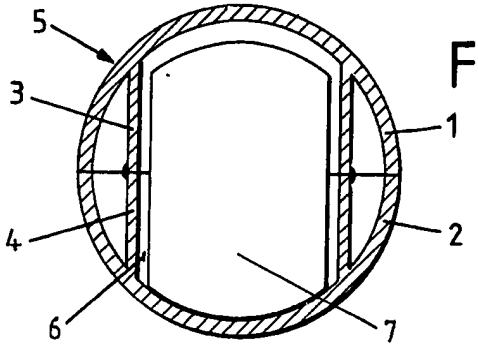



FIG. 1

FIG. 2

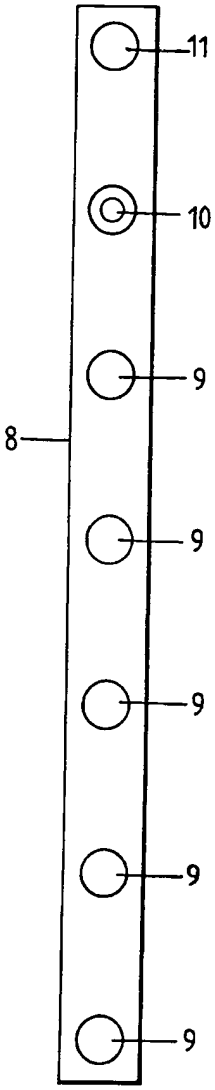
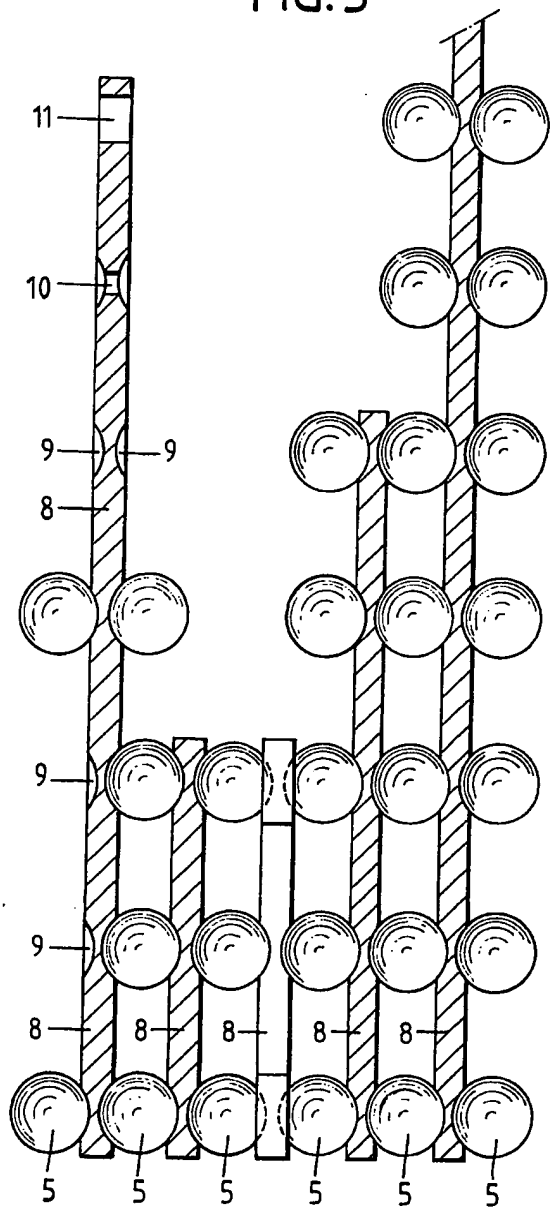



FIG. 3



SPECIFICATION

**A play and instruction apparatus**

This invention relates to a play and instruction apparatus using spherical elements, each element being an assembly of a hollow, spherical envelope, made of a non-magnetizable material, such as a synthetic plastics material and a permanent bar-like magnetic positioned within the envelope and having end faces curved analogously to the spherical envelope.

Such an apparatus with spherical elements is disclosed in German Auslegeschrift 1,239,876. These known spherical elements which have a magnetic field however are constructed in such a way that the magnetic flux is distributed over a maximally large portion of the sphere surface. The bar-like magnets are immovably secured within the elements.

German Offenlegungsschrift 30 00 567 concerns magnetic building blocks that can be used as play apparatus for children are also as model building blocks, for example architects. No requirements are set as to the shape or size of the building blocks nor as to the nature of the material from which these are made and which may for example, be a synthetic plastics material. One or more magnets are embedded within the building blocks and consequently is likewise secured immovably.

The invention seeks to provide a play and instruction apparatus of the above described type having new improved spherical magnetic elements which enable a great many new applications, both for play and instruction purposes.

According to the invention, there is provided a play and instruction apparatus comprising spherical elements, each element being an assembly of hollow, spherical envelope made of a non-magnetizable material, and a permanent bar-like magnet positioned within the envelope, the magnet having end faces curved analogously to the spherical envelope, wherein the weight of the non-magnetic material in the spherical element is minimised relatively to the magnetic strength of the bar-like magnet.

By minimizing the weight of the envelope relative to the magnetic strength of the magnet, the forces to be exerted as a result of the magnetic strength can continue to be strongly active. The envelope, apart from the fact that it serves as housing for the bar-like magnet, has substantially only a spatial orientation function within the total of spherical elements, ensuring the possibility that a rolling movement can be performed by the spherical elements.

These two properties of the spherical elements in combination, together with the strong polarization of the magnetic effect, caused by the fact that each spherical element is provided with only a single bar-like magnet, ensure that, in assembling a structure using the spherical elements, these may be optimally oriented and positioned by automatic rotation according to the magnetic force field. As a result, the stability of the resulting structure is also optimal. With increasing weight of the envelope relative to the magnetic strength, the possibility for the spheres to choose their proper position by automatic rotation decreases and finally may even disappear altogether. In such a case the builder himself would have to choose the optimal position for each spherical element within the structure by manual rotation. The chance that he will be successful however is negligible, since on addition of each successive spherical element to a structure, the entire magnetic force field prevailing between the elements already present is affected and changed. It will be clear that the possibility offered by the spherical elements according to the invention to always choose the proper position within the structure again for all elements by automatic rotation is an important aid in building with the spherical elements, in particular for young children, who have insufficient knowledge of magnetism.

Although partly depending on the diameter of the spherical element, the ratio between the magnetic strength and the weight of the non-magnetic material may be so selected that the weight of the non-magnetic material is not more than about 1 g per 500 Gauss magnetic strength. In practice, a ratio of about 900 Gauss magnetic strength to 1 g weight of the non-magnetic material of envelope and positioning means and a diameter of the envelope of about 17 mm has been found quite manageable.

Positioning means for the bar-like magnetic may be provided within the envelope and may be connected to the envelope in such a way that, within the envelope, the bar-like magnet is movable in axial and radial directions over a distance that is less or substantially less than the diameter of the spherical envelope. Due to the movability of the bar-like magnet within the spherical envelope, an extra variability in respect of the magnetic force field within a group of co-acting spherical elements may be achieved. As a result, the behaviour of the spherical elements within the group may become less predicatable still, which increases the surprise effect on application of the elements as a play apparatus.

The envelope may be formed of two interconnected semi-spherical portions, while within the spherical envelope, the positioning means may constitute a chamber disposed in rotational symmetry about an axis at right angles to the plane of division of the semi-spherical portions.

Partly with a view to an effective manufacture, the magnet may be a right circular cylinder and the chamber may have an annular radial cross-section and may be made of the same synthetic plastics material used for the spherical envelope.

When assembling the spherical element, the two semi-spherical portions may be interconnected in any suitable manner, e.g. by ultrasonic welding along the circumference of the chamber to be formed, preferably within the envelope. It is self-evident that the semi-spherical portions to be assembled may have different colours.

The play and instruction apparatus may be an assembly of the spherical elements and of construction elements made of non-magnetizable sheet material, provided with recesses and/or apertures at a spacing that is equal to or a multiple of the diameter of the spherical elements. The construction

elements, if they are provided with apertures, may have an aperture with a diameter that is sufficiently small that the spherical elements positioned on either side of the strip-like or sheet-like element, in the same aperture do not touch each other. By means of said strip-like or sheet-like elements, structures of various shapes may be made, which moreover may include hollow spaces, while due to the regular distribution of the recesses and holes, numbers play a role, as will be explained hereafter.

If the envelope is made of synthetic plastics material, the material has a given resilience and as a result is sound-absorbing. When handled by children, there is moreover less chance of injuries being caused or receives when e.g. the children throw the spherical elements at each other. Furthermore, also other casing materials may be employed, e.g. ceramic material or wood.

The round form of the elements, in combination with the strongly polarized magnetic field, when used as a toy, offers excellent possibilities of assembling the elements into structures of varying external forms, e.g. a pyramid, cube, rectangle, tower, etc., and a substantially unlimited number of free forms.

In a combination of 100 of the spherical elements, divided in ten groups of ten elements each, while in each group the elements may have the same colour, the elements of the various groups may have different colours. The instructional material may be suitable for use as a so-called three-dimensional counting frame. Consequently, the instruction apparatus in this form may be an aid in teaching children arithmetic. The instruction apparatus may also be suitable for making letters or numbers and in the case of such an application, may again be an educational appliance for children.

The elements associated with the play and instruction apparatus are all actively magnetic and according to the choice of the nature of the material from which the coating of the magnetic core is made, may be designed as substantially "north pole", "south pole" or "north and south pole" elements.

The diameter of the spherical elements is not critical and may be between 0.5 and 7 cm, depending on the purpose for which the elements are to be used. If desired, however, smaller or larger diameters can be provided.

The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:-

*Figure 1* is a cross-section of the centre of a spherical element according to the invention which is arranged in such a way that the bar-like magnet is vertical;

*Figure 2* is an elevational view of a strip forming a construction element e.g. of Perspex, provided with means for interconnecting the strips through the spherical elements; and

*Figure 3* shows a structure formed using the elements of Figures 1 and 2, the strips being of different lengths.

At 1 and 2 are shown two semi-spherical shells made of polyethylene, said two shells having the same or different colours.

The shells 1 and 2 carry internally annular projections 3 and 4 integral with the respective shells 1 and 2 and which, in assembling the shells 1 and 2 to form the complete spherical element 5, determine in conjunction a chamber 6 within which a cylindrical bar-like magnet 7 is disposed. The transverse and height dimensions of the chamber 6 are larger than the corresponding dimensions of the magnet.

The shells 1 and 2 are fixedly connected to each other by an ultrasonic joint along the circumference of the contacting edges of the annular projections 3 and 4.

The strips 8 shown in Figure 2 and 3 are made of Perspex. For the purpose of interconnection of the strips 8 to form structures, one example of which is shown in Figure 3, the strips 8 are provided with recesses 9 on either side and in corresponding positions. Instead of recesses, apertures may be applied, as indicated by way of example at 11, or the central portion of the recesses may have a continuous aperture, as likewise shown by 10, by way of example.

For the purpose of coupling the strips to form structures by means of the magnetic spherical elements, these elements are positioned in the recesses 9 in the manner shown in Figure 3, while the strip is clamped by the elements under influence of the magnetic power of attraction active between the spherical elements.

As shown in Figure 3, an identical radius of curvature has been chosen for a spherical element and a recess, thus counter-acting lateral shift of the strips in a structure relatively to each other. This effect can be reinforced by roughening the external surface of the spherical elements and/or the surface of the recesses.

In order to realize corner joints in a simple manner, the strip-like or sheet-like elements can be provided with flanged edges of sufficient widths for accommodating therein the coupling recesses 9, or they may have a curved form.

It will of course be appreciated that modifications may be made to the play and instruction apparatus as discussed in the above and as shown in the drawings without departing from the scope of the invention. For example, the synthetic plastics material used may be replaced by other material such as wood or ceramics. The colours of the spherical elements may be different. For example in a combination of 100 of the spherical elements, divided in ten groups of ten elements each, while in each group the elements may have the same colour, the elements of the various groups may have a different colour.

CLAIMS

1. A play and instruction apparatus comprising spherical elements, each element being an assembly of a hollow, spherical envelope made of a non-magnetizable material, and a permanent bar-like magnet positioned within the envelope, the magnet having end faces curved analogously to the spherical envelope, wherein the weight of the non-magnetic material in the spherical element is minimised

relatively to the magnetic strength of the bar-like magnet.

2. An apparatus according to claim 1 wherein the envelope is made of synthetic plastics material.

3. An apparatus according to claim 1 or 2, wherein positioning means are provided within the spherical envelope for the bar-like magnet within the envelope is movable in axial and radial direction along a distance substantially less than the diameter of the spherical envelope.

4. An apparatus according to claim 3, wherein the envelope is formed of two interconnected semi-spherical portions, and the positioning means within the spherical envelope constitute a chamber disposed in rotational symmetry about an axis at right-angles to the plane of division of the semi-spherical portions.

5. An apparatus according to claim 4 wherein the magnet is a right circular cylinder and the chamber has an annular radial cross-section an is made of the same material as is used for the spherical envelope.

6. An apparatus according to any one of claims 1 to 5, wherein the apparatus comprises an assembly of the spherical elements and of strip-like or sheet-like construction elements made of non-magnetizable sheet material, the construction elements being provided with recesses and/or apertures at spacings equal to or a multiple of the diameter of the spherical elements.

7. An apparatus as claimed in claim 6, wherein the construction elements have apertures with a diameter sufficiently small to ensure that spherical elements positioned on either side of the construction elements in the same hole do not contact each other.

8. An apparatus according to claim 6 or 7, wherein construction elements are provided having a curved surface.

9. An apparatus according to claim 6 or 7, wherein construction elements are provided which have a generally flat-surface.

10. An apparatus according to any one of claims 6 to 9, wherein the construction elements have a flanged edge.

11. A play and instruction apparatus substantially as described herein with reference to the drawings.

12. A spherical element comprising a spherical envelope of synthetic plastics material and having a magnetic field for application in the play and instruction apparatus according to any one of claims 1 to 11.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company Limited, Croydon, Surrey, 1984.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.